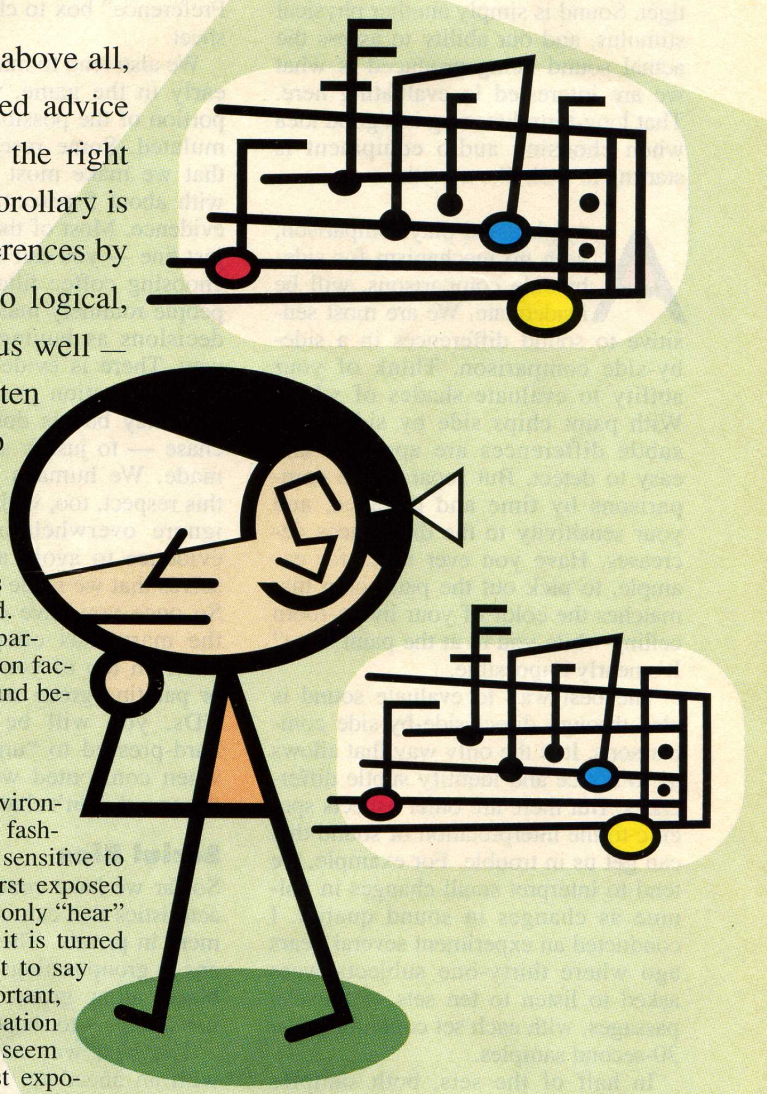
Can You Trust Your Ears?

Perhaps — if you use your head, too

BY TOM NOUSAINE

"Relax, listen carefully over the long term, and, above all, trust your ears." So goes the most often repeated advice from friends, reviewers, and salespeople about the right way to evaluate sound quality. An often quoted corollary is that you may have to "learn" to hear certain differences by listening over extended periods. It all sounds so logical, too. We use our ears constantly, and they serve us well — at least they saved our ancestors from being eaten by tigers. Isn't it natural to rely on them to help us pick out audio equipment?



Unfortunately, our ears can't always compensate for some of the error mechanisms that are present during typical open listening sessions in living rooms and audio salons. By "open" I mean without control mechanisms to prevent listener bias from influencing the results. I call open listening sessions "plug-and-play" because you just disconnect the old amplifier (or whatever), plug in a new one, and let 'er rip. That's what you usually do when you get a new piece of gear in your living room, and, with a few clever twists, it's the standard operating procedure on the sales floor.

Listener bias can be sorted into three primary categories: sensory, psychological, and social. The bias mechanisms might remain hidden in the plug-and-play environment, but they are always there, and they insure that the listening evaluations will be contaminated. The results will be partially or wholly based on factors *other* than the sound being produced.

ILLUSTRATION BY J. D. KING

Sensory Bias

Humans sense the environment in a differential fashion, and we are most sensitive to any stimulus when first exposed to it. For example, we only "hear" or notice a fan when it is turned on or off. That is not to say training is never important, but for sound-evaluation purposes differences seem more dramatic on first exposure. Furthermore, with continued exposure we quickly adapt or equalize ourselves to any stimulus. We stop hearing a fan after a

short while, and it turns into sonic wallpaper. We can even have different sensory responses to the same stimulus. You feel cold both when you first jump into a pool and again when you get out, even though the air temperature hasn't changed at all.

These simple examples show how our differentially based sensory system can respond in different ways to the same stimulus and how those responses can vary over time. Try a little experiment to highlight this point. Repeat a 30-second musical passage several times and notice how you hear different things each time. We can hear differences with the same music because we are constantly scanning for differential information and will often sense a change just to help us avoid that one fatal error with the tiger. Sound is simply another physical stimulus, and our ability to assess the actual sound being produced is what we are interested in evaluating here. That long-term listening is a good idea when choosing audio equipment is starting to look like a myth.

Any plug-and-play comparison, with no mechanism for side-by-side comparisons, will be inadequate. We are most sensitive to sound differences in a side-by-side comparison. Think of your ability to evaluate shades of white. With paint chips side by side, even subtle differences are apparent and easy to detect. But separate the comparisons by time and distance, and your sensitivity to the differences decreases. Have you ever tried, for example, to pick out the paint chip that matches the color of your living-room ceiling while you're at the paint store? It's nearly impossible.

The best way to evaluate sound is also through direct side-by-side comparisons. It is the only way that allows us to notice and identify subtle differences. But there are other aspects specific to the interpretation of sound that can get us in trouble. For example, we tend to interpret small changes in volume as changes in sound quality. I conducted an experiment several years ago where thirty-one subjects were asked to listen to ten sets of musical passages, with each set containing two 30-second samples.

In half of the sets, both samples were played at precisely identical volumes. In the other half, there was a 1-dB difference in level between them. Although people had a strong tendency to "prefer" the louder alternative (especially when it came as the second of two), not one of the subjects reported volume or level as a discriminating factor. All comments on how the sound changed were couched in quality terms such as "cleaner" or "more harsh" even though volume was the only thing that had changed.

Psychological Bias

Our psychological biases make us susceptible to cognitive errors in judgment. We are, for example, programmed to make choices and are perfectly happy choosing a favorite from identical alternatives. In the experiment described above, the subjects said that they "preferred" one of two identical sound clips more than 75 percent of the time, even when there was a "No Preference" box to check on the score sheet.

We also tend to make decisions very early in the game, with only a tiny portion of the possible evidence accumulated. Some researchers estimate that we make most of our decisions with about 5 percent of the available evidence. Most of the time that works just fine — you can't go too far wrong choosing coffee filters this way. But people routinely make such important decisions as buying a car the same way. There is evidence that most of the information people gather about cars they buy is done *after* the purchase — to justify a decision already made. We humans are imperfect in this respect, too, willing to discount or ignore overwhelming contradictory evidence to avoid admitting to ourselves that we made a wrong decision. So once you have decided to "hear" the marvelous effects of placing a brick on top of your power amplifier or painting green stripes around your CDs, you will be psychologically hard-pressed to "unhear" them even when confronted with evidence that the sound didn't change.

Social Bias

So far we have concentrated on characteristics that can influence our judgment in private. The plot really thickens in group settings, where our social biases allow group dynamics — and not sound — to shape what we "hear."

The best way to illustrate this is with an anecdote. I attended a press conference unveiling a new speaker a couple years ago. When my seatmate leaned over to tell me what he was hearing and to ask my opinion, I just made up something that sounded plausible. Sure enough, after the next sequence we reconvened, and he intimated that he had "heard" what I had told him I heard. He seemed a trifle miffed, though, when I refused to acknowledge what he had heard or to negotiate an agreement. You can try this one at home too. Just be careful about whom you use as a subject!

The scenario that I just described is played out over and over again in audio demonstration rooms and living rooms across the country. When the host fires up the system with his hot new amplifier, guests initially report hearing different things, but after a few replays the group negotiates a consensus about how the new amplifier "sounds." What we have with this kind of open interaction is an exercise in group dynamics, not an exercise in sound evaluation.

The potential for error here is large, especially when someone present has a special status. If Neil Young were in the crowd, you can bet that many would defer to his judgment. I know I would. But the authority figure doesn't even need to be present. A salesperson will gladly prime the pump by telling you in advance what "most people" and favored reviewers hear when they listen to this amplifier. He will also skillfully negotiate differences: "Well, maybe you didn't perceive the better rhythm and pace, but surely you heard the improved liquidity in the midrange." It happens all the time.

Now let's check out the more crassly commercial aspects of group behavior and audio evaluation. First of all is the hidden assumption that the product being demonstrated actually does sound different from some other product. In an audio salon "no difference" is not an acceptable answer. You can argue over what the differences are, but never question whether differences actually exist. Woe be unto the audiophile who can't hear differences — even inaudible ones.

Another often hidden factor is the agenda of the host. Whether he's a salesperson or a good friend, he wants your concurrence that something sounds good. The salesman wants you to buy the product — that's his job. He may be your friend, too, but he will tend to confuse his sales commission with sound quality. If he didn't he wouldn't be a good salesman. Likewise, your buddy wants your approval of his investment or his latest tweak. If he really wanted your true opinion, he

would give you a private score sheet and let you write down comments that he could evaluate later. Your approval and confirmation are being solicited. The high sound quality of the equipment being demonstrated is a given.

How It Plays Out

Now that we know what to watch for, let's see how all these bias factors play out in the sales routine. Here's what happened to me several years ago when I dropped into a suite at the Consumer Electronics Show to audition a certain loudspeaker. I was in the wrong suite, but the product demonstrator there suggested that his cable conditioner, costing several hundred dollars, would improve the sound more than a change in speakers. He then offered to let me "audition" the effects of this device by comparing a conditioned interconnect cable with an unconditioned one. Always the skeptic, I allowed him to demonstrate the cables, but I asked him to select music where the differences would be as large as possible right from the start.

So we had a "blind" demo where the demonstrator hooked up one cable and then another seemingly identical one and played a minute or two of a CD using each of them. There were two other people present during the demo. Afterwards the host asked expectantly which cable we "preferred." The other two people were split. One "liked" the first, the other the second. I just said they sounded the same. And they did. The host responded that he would repeat the demo with "better material." What? Hadn't I asked for the "killer demo" on the first run?

The demo ran for two more trials. The other listeners didn't "like" the same cable until the last trial. After they acknowledged that they both preferred the conditioned cable on the third try, the demo was over.

Let's look again at the routine used for the presentation to spot where bias was introduced: 1) The host carefully primed the pump by telling us what we were going to hear in the demo. 2) The scoring was heavily prejudiced by the "which one did you like" format; there was no easy way to say they were the same. 3) The host always started the demo with the volume control at full off and turned it up slowly as he began each music segment. He turned it down when he swapped cables and between trials, so there was no way to insure that levels were closely matched. Although it wasn't blatant, the second sequence was always just a little louder than the first. 4) The 15 to 20 seconds between each comparison and the 2 minutes between the segments were way too long for us to have good sensitivity to any differences. 5) The conditioned cable was always presented second. 6) Listeners were allowed to chat before deciding their preferences. 7) When "wrong" answers were given, the process was simply repeated until the "right" answers were obtained. Past results were then ignored, and the demo was brought to an end.

There were no records kept, and no scientific controls of any kind were applied. Yet the other two listeners (one of them a professional audio reviewer who should have known better) declared their amazement that such a device could "change" the sound of a cable, conveniently forgetting that neither of them had agreed on what was what during the first two trials where the most revealing material was used. Plug-and-play at its best! No "sound" was being evaluated here. The answers were known in advance, and the routine was guaranteed to leave many listeners thinking they had heard differences when there were none. It is tempting to think, "Maybe they did hear differences." But if so, why didn't they hear them in the first trial? Why not with the best material?

When you are shopping for audio gear you will experience this routine, in one form or another, again and again. It can't happen to you? If you are really honest, you know that it can because it *has* in the past. Watch carefully for the clues, and you will see it played out over and over — even at your own house when you have friends over to hear your new Gizmotron.

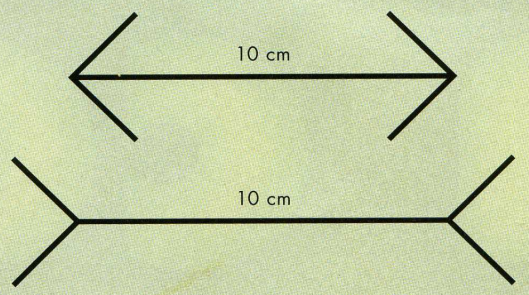
Unfortunately, you can't overcome bias just with willpower and good intentions even when you are aware of it. There is a common notion that if you hear something you didn't expect to hear, then you have become an experienced listener who is able to tune out bias. Well, it doesn't work that way even with bias that you know about.

Optical illusions like the Müller-Lyer lines shown here give us insight into sensory bias. The center lines are exactly the same length. But even after you measure them yourself, you won't be able to "see" the lines as being equal no matter how hard you squint. You cannot just tune out audio level mismatches, either. You cannot avoid the differential nature of human hearing, which is constantly scanning for changes. The moral is that humans cannot just tune out bias. Some cognitive errors are built in. Furthermore, much of our prejudice is buried in the subconscious, safely out of the reach of willpower. So where does that leave us?

Once we understand how bias works, plug-and-play auditions at an audio salon will never carry the same level of mystery. It is relatively easy to produce a situation where people can be induced into hearing differences between sonically identical products. We also know that a fair listening comparison is very difficult to arrange. Level matching and other procedures needed for bias-free evaluations are not easy tasks even for experienced testers. Knowledge of our innate error mechanisms will go a long way toward keeping the quest for perfect sound headed down the right road.

No one has ever produced a scientifically controlled listening test showing that well-designed amplifiers (flat response, no clipping), preamplifiers, integrated circuits, and speaker wires (16-gauge and bigger) have the slightest effect on the sound being produced. Special capacitors, absolute polarity, dots, clamps, green pens, bricks, and assorted other things also won't change the sound from a stereo or home-theater system, although people can be made to think so. Why? Listener bias can make people hear unverifiable "differences" in sound. □

MÜLLER-LYER FIGURE



Yes, both horizontal lines are the same length, even if your built-in bias won't let you see it.